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| 1 | (General) | The FS report shall include a detailed discussion of all problems noted with the TCRA cap and corrective actions performed to date or planned. Also, this discussion shall include the issues/recommendations identified in the U.S. Army Corps of Engineers' cap assessment. | Additional text added in Section 2.5.3 to describe TCRA maintenance activities and reassessments conducted by Respondents and USEPA/USACE. |
| 2 | (General) | Statements regarding a recommended or preferred remedial alternative shall be deleted from the FS.<br>The EPA will recommend a preferred alternative in the Proposed Plan for public comment, and will select a final remedial action for the site in the Record of Decision based on an evaluation of the CERCLA criteria after considering public comment. | References to the recommended remedy have been removed. |
| 3 | (General) | An additional remedial action alternative shall be included for the northern waste pits. This new alternative shall evaluate a removal that addresses a volume of material that contains dioxin/furan at levels greater than 220 ng/kg, except where the water depth is greater than 10 feet. Where the dioxin/furan levels are greater than 13,000 ng/kg, the water depth limit shall not apply. This alternative shall also include an engineered control (sheet pile, berm, etc.) to isolate the excavated area from the river (unless constrained by river hydrologic/USACE requirements). An engineering control would improve the containment of re-suspended sediment during removal, which would reduce impacts to water quality, sediment quality, and fish. The excavation could be sequenced to work from the center of the area that is above mean tide level towards the perimeter. The new alternative shall also consider the impacts of this construction on the river hydrologic conditions, need for USACE permits, etc. | A new alternative (5aN) has been developed in coordination with USEPA and is included in the Draft Final Interim FS. This alternative includes the elements described in the comment. |

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| 4 | (General) | The FS Report shall consider the potential for erosion and releases of contaminated material due to a major storm for each of the alternatives, and the relative impact should such a release occur. | Additional text has been added under the short-term effectiveness evaluation for Alternatives 3N through 6N to discuss the potential for a storm to occur during construction and while the Armored Cap has been removed, based on new modeling that is described in the revised Appendix B. **Respondents simulations of Alternatives 4N-6N indicate that they are 30-40% likely to fail (have a major release), which makes the Alternatives non-protective. EPA should require that Respondents include sufficient protective measures (or more realistic release assumptions), with a lower than 10% probability of failure. Corresponding other changes in the text discussing these alternatives would then be required.** |
| 5 | (General) | The FS Report shall describe the conditions where incineration would be required. | Because landfills have been tentatively identified as potentially accepting the excavated material without incineration, language regarding incineration has been removed from the revised FS Report. |
| 6 | (General) | The monthly site reports note that there are potential impacts from San Jacinto River Fleet's operations such as suspending sediments in the area. The FS shall note that the Remedial Design will include provisions for re-sampling the sediment area(s) that exceed the final sediment remediation goal to confirm the depth of the exceedances. | Additional text was added in Section 4 to describe data collection that would be performed during remedial design for solidification and removal alternatives. This data collection would include information on the depth of exceedance. |
| 7 | (General) | The FS Report only considers institutional controls for the Southern Impoundment area. The FS shall include a range of alternatives for this area similar to the range of alternatives in the northern waste pits, including treatment and/or removal. | Additional alternatives have been developed for the area south of Interstate 10. These alternatives include Enhanced Institutional Controls (EIC) and Removal and Off-site Disposal. **Comments on the remedial alternatives presented for the Southern Impoundment Area are included in HDR's memorandum.** |
| 8 | (General) | No costs are included for institutional controls. The FS shall include these costs as appropriate. | Costs for Institutional Controls have been added. See revised Appendix C for details. |
| 9 | (General) | The FS shall clarify if dewatering costs and effluent disposal costs have been considered while developing the cost estimates for Alternatives 5 and 6. | New text added as introduction to Appendix C, which includes clarification on this issue. |

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| 10 | (General) | The FS shall clarify in the detailed analysis if USACE permits or other relevant permits are applicable to the implementation of the alternatives while addressing the Site. The FS shall consider the impact of any construction in the flood way of the River (impact on flooding and any offsets for this displacement that may be needed). This includes leaving the cap in place as it is or making any additions to its height or overall footprint. | Permits are discussed in Table 3-1. Specific flood plain modeling results are discussed with new text added under the ARARs evaluation in Section 5. |
| 11 | (General) | Please clarify why costs for five year reviews and present value analysis have not been included for each of the Alternatives. Please clarify if any periodic costs have been considered for the maintenance of institutional controls in each of the Alternatives. | New text added as introduction to Appendix C, which includes clarification on this issue. The cost for 5-year reviews has been added, as has the cost for implementing Institutional Controls and Operations, Monitoring and Maintenance using a net present value (NPV) analysis. |
| 12 | (General) | The FS shall consider as an ARAR the Toxic Substances Control Act (TSCA) governing transport, handling, and disposal of PCB-contaminated sediment or residues. | Added TSCA as a new line in Table 3-1, including explanation for why it does not affect evaluation because PCB levels are below TSCA criteria. |
| 13 | (General) | The cost estimating tables in Appendix C of the FS shall include specific line items for establishing and monitoring institutional controls (for each alternative where ICs are included). | These items have been added to the cost tables in Appendix C. |
| 14 | (General) | The design approaches noted for the containment alternatives shall be in accordance with the U.S. Army Corps of Engineers recommendations developed in reference to the previous erosion of the TCRA cap, and revisions to the alternative descriptions and cost estimates shall be reflected in the FS Report. | The capping alternatives incorporate and, in the case of those that include a Permanent Cap, exceed USACE recommendations made during its review of the Armored Cap design and construction. Additional text has been added to Section 4 related to these recommendations, and to cap design guidance as appropriate. |
| 15 | (General) | Worker safety concerns are discussed in the FS. It is noted that Alternatives 4, 5, and 6 include increased probabilities of non-fatal and fatal injuries compared to the other alternatives. The FS shall also state that all worker safety concerns will be appropriately addressed in the Remedial Design phase of the project with detailed health and safety plans. Complex remedial actions at other Superfund sites and including the TCRA implementation at the site have documented that safety concerns can and should be appropriately addressed. | Additional language has been added to Section 4 where safety risks are discussed. **The revised text continues to unduly emphasize safety issue, e.g. *Section 4.3.5, p. 54; Section 4.4.1, p. 59.*** |

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| 16 | (General) | The FS notes that Alternatives 4, 5, and 6 will result in increased emissions compared to the other alternatives. Greenhouse gas, particulate matter, and ozone emissions associated with the alternatives will not have a significant impact compared to the three to five million cubic yards of dredging occurring annually for the Houston Ship Channel/Galveston Entrance, as well as the industrial/ commercial nature of the immediate site area, the presence of highly trafficked transportation corridors (I-10), and ambient air quality that exists. FS shall either delete the statement or shall include additional text that the emissions will not have any significant impact to the area. | The FS is intended to compare alternatives to one another, not to unrelated factors outside the scope of the cleanup. The discussion of emissions was prepared to provide a comparative evaluation of emissions from one alternative to another. Additional text was added in Section 5 to acknowledge that there are other significant sources of air emissions and traffic in the region. **Several subsections of 5 still unduly emphasize traffic impacts and other "Green Remediation" issues. EPA guidance on Green Remediation should be considered, but it should not modify the remedy selection criteria to be evaluated in the FS.** |
| 17 | (General) | The FS has no discussion of floodplain management and impact considerations of construction in the floodplain and floodwater pathways and how that would impact flood control, river pathway and water flow issues and obstructions in navigable waters. The FS shall include a discussion of these issues. In addition, the FS shall clarify in the detailed analysis if USACE permits or other relevant permits are applicable to the implementation of the alternatives while addressing the submerged areas. | Discussion of federal permit requirements is provided in Table 3-1. Flood impacts were evaluated and included in the revised Appendix B, and additional discussion of flood plain impacts (short term and long term) associated with each alternative has been added to the detailed evaluation of alternatives in Section 5. **It is assumed that the analysis in Appendix B will be reviewed by EPA/USACE.** |
| 18 | (General) | The FS shall include costs for five year reviews, and shall describe the assumptions used for the present value analysis, including discount rate, for each of the Alternatives. The EPA requires that present value analysis use a discount rate of 7%. | These costs have been added, and NPV has been computed using a discount rate of 7%. See revised Appendix C for details. |

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| 19 | (General) | The computer model application to the Site makes numerous assumptions and simplifications.<br>Although many of the assumptions are typical of other model development efforts, the uncertainties these assumptions introduce into the model application in the FS were generally not clearly identified or assessed. Uncertainties that may impair the model's ability to evaluate FS alternatives shall be clearly identified and assessed, including the following:<br><br>(comment split into 19a, 19b, 19c, 19d, 19e and 19f for response purposes) | Anchor QEA disagrees with this comment's assertion that model uncertainties were not clearly identified or assessed. First, key model uncertainties were identified, described, and evaluated as part of the model development, calibration, and sensitivity analysis process (as summarized in Anchor QEA 2012a). Furthermore, this work was expanded upon in the Draft FS, whereby quantitative uncertainty bounds were developed for the model predictions so an assessment of how uncertainty affects the conclusions could be made.<br><br>Furthermore, as noted in the comment, many of the assumptions in the model are typical of other model development efforts. While these assumptions introduce some amount of uncertainty into the model predictions, they do not impair the model's ability to evaluate the FS alternatives (on a relative basis) since these uncertainties are common among all alternatives.<br><br>The above notwithstanding, additional explanatory text was added in multiple places (e.g., Section 1.1.1 and the beginning paragraphs of both Sections 3 and 4) to acknowledge that model uncertainty exists, but that most sources of uncertainty do not affect the conclusions of the modeling since they are based on relative comparisons. Also, where appropriate, clarifying text was added to the document to address the specific concerns listed in the bullet points of this comment (see below for a point-by-point response to each of the uncertainties listed in this comment).<br><br>**The response obfuscates sensitivity analysis and uncertainty analysis and does not provide a direct response to the comment. The model is not highly quantitative because it has been artificially constrained and its major uncertainties, and how they impact the balance of fate processes, have not been addressed. The response simply says that some uncertainties were identified and that there is some exploration of sensitivity. However, the response does not address how uncertainties in upstream loads and uncertainties in other aspects of model parameterization impact model reliability.** |

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| | | | **The generic statement that assumptions in the SJR model are similar to those made in other models does not address the comment. The SJR model may not be reliable even in determining the relative differences in the outcomes between simulations because biases in the way deposition and NSR occur in the model relative to erosion means that the model users would conclude alternatives that depend on a more consistently deposition environment (i.e. capping) may be more beneficial (and thereby be given a higher weight) than alternatives that would be more favorable in a more dynamic environment subject to more periodic erosion (i.e. removal). Furthermore, the revised FS does not consistently provide the same interpretations. The FS text and conclusions should reflect these same qualifications of the model results.** |
| 19a | (General) | Representation of upstream boundary conditions, particularly sediment loads at the Lake Houston Dam. Figure 4-15 of the Fate and Transport Study suggests that suspended sediment concentrations (SSC) at any f1ow rate range by a factor of 2 at the low end of the flow spectrum to nearly a factor of 100 at moderate to high flow rates, given the nearly two orders of magnitude variation in SSCs at typical river flow rates. It is unclear what basis was used to conclude that examining a factor of 2 in upstream load estimates provides a "quantitative evaluation" of uncertainty. The FS shall clarify this. | The basis of the factor of two variation in annual sediment load at Lake Houston Dam was the sediment rating curve used to specify the incoming load, which was presented on Figure 4-15 of the Chemical Fate and Transport Study Report (Anchor QEA 2012). The relationship between suspended sediment concentration (SSC) and flow rate on that figure indicates variability in SSC at any specific flow rate, which is typical for a river system. The sediment rating curve for calculating the incoming sediment load (i.e., SSC as a function of flow rate) was developed by conducting a log-linear regression analysis of the SSC and flow rate data, see Equation 4-5 of Anchor QEA (2012a). That equation can be re-written as:<br><br>$SSC = 2.88\ Q^{0.49}$<br><br>where SSC is suspended sediment concentration (mg/L) and Q is flow rate (cfs).<br><br>A factor of two variation in annual sediment load was specified by varying the coefficient (2.88) in the sediment rating curve to generate lower- and upper-bound sediment rating curves:<br><br>Lower-bound: $SSC = 1.44\ Q^{0.49}$<br>Upper-bound: $SSC = 5.76\ Q^{0.49}$ |

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| | | | The lower- and upper-bound sediment rating curves specified by the equations above are in general agreement with the range of the SSC data. More importantly, a factor of 2 was selected for the sensitivity analysis to understand the model response to changes in the upstream load, while also maintaining fidelity to the model calibration (i.e., increases or decreases beyond a factor of 2 would result in the model being out of calibration with respect to the net sedimentation rate [NSR] data). **The sediment data show wide variations in erosion and deposition (see USGS and NTSB [page 38] interpretations of 1994 flooding), belying the claimed accuracy of the model used for the FS. While the model applied may be as good as others applied to FSs, its inherent uncertainties in its predictions must be noted wherever the results are cited in the FS.** Therefore, the approach for varying the annual incoming sediment load during the sensitivity analysis is valid and consistent with site- specific data. Additional explanatory text supporting the use of a factor of 2 was added to Section 3.1.1.2.<br><br>**The response confuses sensitivity analysis and uncertainty analysis. Uncertainty includes uncertainties in inputs and the corresponding range of variable for each model process parameter. The collective bounds of all uncertain elements of the model contribute to the maximum and minimum simulation bound for the model. The NTSB report documents that the forces that occur in the San Jacinto River are much larger than suggested by the model as evidenced by the meander loop cutoffs and the range of flood damage, including widespread erosion that undermined pipelines throughout the area. For example, NTSB (p. 38) reports 10 ft of erosion in the vicinity of the site.** |

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| 19b | (General) | Simulation of sediment transport and the representation of hard bottom areas along the river channel<br>downstream of Lake Houston. | The domain of the San Jacinto modeling framework extends up to Lake Houston Dam in order to produce<br>realistic and reliable simulations of tidal hydrodynamics in the system, as discussed in Anchor QEA 2012.<br>The river channel between Lake Houston Dam and the Grennel Slough area was treated as a hard bottom (i.e., no erosion and deposition) because the simulation of sediment transport processes in that region was not necessary for accurate and reliable simulation of sediment transport within the USEPA's Preliminary Site Perimeter. This approach is appropriate given that the model's predictions were calibrated to NSR data collected within USEPA's Preliminary Site Perimeter. Furthermore, limited bed property data are available in the river channel upstream of the USEPA's Preliminary Site Perimeter, which would have introduced uncertainty in model predictions of erosion and deposition in the river channel. **This uncertainty needs to be recognized in the evaluations and interpretations of the model results. If the upstream areas in fact are subject to deposition of sediment, less (or none) is available to be deposited as hypothesized in the site vicinity, as is claimed in the revised FS.** This approach of extending hydrodynamic model boundaries beyond those of a coupled sediment transport model is commonly used in tidal systems. Thus, simulating the river channel upstream of the USEPA's Preliminary Site Perimeter as hard bottom is a valid approximation that had minimal effect on model predictions within the USEPA's Preliminary Site Perimeter.<br><br>**The FS should discuss the implications if sediment was modeled as accumulating in the upstream region (between the Houston Dam and the USEPA Site Perimeter). The response ignores the comment. Physics upstream of the SJRWP site are neglected such that the upstream boundary is allowed to propagate into the study area. Whatever sediment load goes over the dam would be subjected to backwater effects caused by the tide and changing water levels. Uncertainty in that simulated load will impact net sedimentation in the model domain near the waste piles. A potentially artificially high sediment load is being used as an infinite source of sediment to drive a net sedimentation parameterization that favors deposition relative to erosion.** |

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| 19c | (General) | Oversimplification of processes, particularly the failure to account for the influence that salinity differences is expected to have on fine sediment deposition. | The approach for simulating cohesive sediment deposition in the model has been successfully applied to numerous contaminated sediment sites across the country, which include fresh, saline and brackish water environments. In addition, this approach has been reviewed and approved by USEPA technical experts (e.g., Dr. Earl Hayter of the U.S. Army Corps of Engineers). Simplifying assumptions and approximations need to be made for any sediment transport modeling study. However, the successful calibration and validation of the sediment transport model for the San Jacinto River study demonstrated that the approximations used in the model are valid. **"Successful calibration and validation" are subjective terms; the limitations of the model and its predictions must be recognized where interpreted for purposes of the FS, as noted elsewhere in these comments. The FS text should be revised as noted in detailed comments. The response fails to address the fact that parameters determined by shorter-term calibration periods can still have enough uncertainty ("slack") to yield a wide envelope of response during long-term simulations. How uncertainty in model results may impact outcomes in FS evaluations should be acknowledged.**<br><br>**Similarly, with the other response AQ's rebuttals generally do not address that the model can get results that "look right" in the water column or the bed but that those results may be obtained by the wrong processes. For example, the model could generate a seemingly reasonable simulation given a number of combinations of offsetting errors in parameterizing loads, erosions rates, grain size distributions, and other model elements. The response does not address this.** |
| 19d | (General) | Representation of model initial bed properties such as grain size distributions. | The methodologies used to specify the initial bed composition in cohesive and non-cohesive bed areas<br>were based on an objective approach that used site-specific data to the fullest extent possible, as discussed in detail in Anchor QEA (2012). While other methodologies could have been developed, the approaches used in this study are valid because the resulting initial conditions are consistent with site- specific data. Furthermore, the sediment transport model predicts temporal and spatial changes in bed composition during a simulation. Thus, initial conditions for bed composition have a minimal effect on model predictions for multi-year periods. |
| 19e | (General) | Simulation of net sediment transport within the Preliminary Site Perimeter. | To the extent that USEPA needs additional information regarding the simulation of net sediment transport, we request additional clarification on the specific question contained in this comment. |

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| 19f | (General) | Application of the model at spatial and temporal scales finer than the scales over which model performance is reliable. | Additional text was added to Section 3.2.2.1 recognizing that model uncertainty is generally higher at smaller spatial scales than it is at larger spatial scales. For example, water column and sediment results<br>averaged over relatively small scales such as the TCRA footprint tend to be somewhat more uncertain that results averaged over larger areas. However results at these smaller scales were presented for comparison purposes only and are not a significant differentiator among the simulated scenarios. The main results from the modeling used in the FS to support comparative evaluations of remedial alternatives were mostly based on averaging over a site-wide (USEPA's Preliminary Site Perimeter) scale, or 1-mile sections of the river. These relatively coarse scales are considered appropriate for this model given that data for calibration were generally available at these scales.<br><br>**The text of the FS does not adequately reflect that MNR evaluation using the model only estimates averaged sediment accumulation over large areas (the entire EPA Site Perimeter). Actually, the model results and the field data indicate that deposition of sediment will likely occur in some areas within the Site Perimeter and erosion will occur in others (as reported by NTSB). Additional areas of erosion (and possibly deposition) would be known if more Site data were available. Over periods shorter than those reliably simulated by the model (shorter than one year) one cannot predict whether erosion or deposition will occur. The response demonstrates the potential flaw in the overall modeling approach and the claim that the model is quantitative. The scale for which model calibration is considered valid was 1-mile long sections of the river. However, when used in the FS, particularly as a tool to help evaluate alternatives involving capping/armoring, the model is in essence being used at 1-10 meter scales, not a 1-mile scale. The NTSB flood report findings also demonstrate that river conditions during floods (and forces acting on the river bed and banks) may be very different from conditions as simulated in the model.**<br>**See also Comment #56. There, the response is that results vary in time and space, which precludes the model from being in agreement with "point" data, which is in direct opposition to this 19f Response.** |
| 20 | (General) | The Texas Surface Water Quality Standard (30 TAC 307.6 (d)) provides numerical human health criteria in Table 2, including TCDD Equivalents (dioxins, furans, and PCBs). The FS shall discuss this criteria relative to the Site in accordance with 30 TAC 307.6 (d)(11). | Additional text added to Table 3-1 to discuss this standard. |

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| 21 | (General) | Redacted | |
| 22 | (General) | The FS shall describe how the unit costs were calculated and how the quantities were determined. | Supporting information has been developed and is provided in the revised Appendix C. |
| 23 | (List of Acronyms and Abbreviations) | The FS shall add BCT, BAT, POTW, TCMP, TMDL, MCL, CMP, RCRA, NFIP, TCCC, MOU, T&E, CRNA, and CZMP (define in text) to acronym list at the beginning of report. | References added and defined where appropriate. Reference to CZMP has been modified where it appears in Table 3-1 to "CMP" and no definition of CZMP is therefore needed in the revised FS. |
| 24 | (Section Executive Summary, p. ES-2) | The FS states that Alternatives 1, 2, and 3 provide greater long term effectiveness than Alternatives 4. 5, and 6. This statement shall be deleted. Alternatives 1, 2, and 3 do not include any reduction of volume or mobility nor any treatment or removal/disposal, as do Alternatives 4, 5, and 6. Treatment and removal remedies have been successfully designed, implemented, and monitored /maintained to ensure remedial action objectives are met at Superfund sites across the U.S. | The discussion about long-term effectiveness was modified to address this comment. **Neither this summary nor the changes to the FS text adequately address EPA's comment that the FS fails to adequately describe the differences among these groups of alternatives.** |
| 25 | (Section Executive Summary, p. E-3) | This section states that" ... an outcome that has been documented at other sediment remediation projects in spite of significant efforts ... " The FS shall provide a reference (s) for this statement. | References have been added. |
| 26 | (Section Executive Summary, p. ES-3) | Statements that there are no increased long-term benefits for Alternatives 4, 5, and 6 shall be deleted.<br>As noted in the previous comment, these alternatives result in a reduction of volume or mobility, and include treatment or removal/disposal, which are important considerations for long-term permanence. Treatment or removal/disposal provides additional long-term protectiveness benefits compared to not doing treatment or removal/disposal. Similarly, statements that Alternatives 4, 5, and 6 provide less environmental benefit and reduction of risk shall be deleted. It is noted that the relative potential of the various alternatives for releasing contaminated material is an important issue and will be assessed as a part of the remedy selection process. | Language clarified to indicate that the modeling does not predict long-term benefits from stabilization and removal due to impacts from releases during construction.<br><br>**The language inserted does not adequately address EPA's comment. The FS should represent a balance of known experience, skilled engineering and operations plans to mitigate impacts, and planning for adverse events. Those factors should not be ignored when models with great uncertainty show adverse effects. Rather the model results should be cross examined and, if validated, the alternative should be scoped to address those issues.** |

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| 27 | (Section Executive Summary, p. ES-3) | This section describes the drawbacks to Alternatives 4, 5, and 6, but does not discuss their benefits. The purpose of a FS is to evaluate the pros and cons of the alternatives so that their relative merits can be weighted and the best overall alternative can be selected based on the nine CERCLA criteria. This section shall also include a discussion of the merits of Alternatives 4, 5, and 6 (treatment, removal. long term protectiveness, etc.). | Additional text has been added to describe the merits of removal and treatment, including reduced or eliminated need for OMM associated with capping. **The added text does not adequately provide a balanced evaluation to adequately address EPA's comment.** |
| 28 | (Section Executive Summary, p. ES-3) | This section mentions the greater implementation uncertainty for Alternatives 4, 5, and 6.<br>Containment, treatment, and removal remedies have been successfully designed and constructed at many sediment sites in the U.S. Higher uncertainties during implementation are inherent in more robust remedies; however, proper design should account for this. The uncertainty discussion shall be modified to also note the technologies' successful application experience with proper design. | We acknowledge that proper design of treatment and removal remedies may serve to mitigate the risk; however it is important to consider implementation risks in remedy selection and thus we have retained some discussion along these lines. Additional text has been added to acknowledge that removal strategies have been implemented at other sediment cleanup sites, including addition of a list of sediment projects where removal has been the remedy. **An alternative that has a 30-40% probability of failing due to a storm is not an acceptable Alternative concept. These alternatives must be re-specified to include sufficient controls and methods to maintain a credible protection level during implementation, e.g. less than "x"% likelihood of failure (as approvable by EPA).** |
| 29 | (Section 2.2, p. 5) | The FS shall provide detail regarding the statement that land uses north of the Site including industrial and municipal activities that may result in releases of dioxins and furans. | Additional text and a reference to the RI have been added to Section 2.2. |
| 30 | (Section 2.4.2, p. 9) | The FS states that "Near-bed velocities generated by episodes of propeller wash are expected to be significantly higher than those due to tidal and riverine currents ... " whereas, Section 2.2.1 states access to the TCRA Site via boat is currently constrained to the North, West, South and Southeast. The FS shall clarify this apparent inconsistency. | Note that the Section 2.4.2 discussion was not intended to apply to the TCRA Site in the Draft FS. Additional language added to Section 2.4.2 to clarify that this discussion applies to navigation areas of the river. |
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| 31 | (Section 2.5.3, p. 13) | This section states "Technologies used to withstand forces sustained by the river must be structurally sufficient to withstand a storm event with a return period of 100-years .... " However, complete erosion of the armor material occurred in some areas of the TCRA cap within a year of its construction, apparently by a routine storm event, exposing the underlying geomembrane, although a release did not occur. The FS does not sufficiently demonstrate that an enhanced version of the same technology would be able to withstand a severe storm event. The FS shall provide this demonstration. | The Respondents disagree with the characterization that "complete" erosion occurred considering the localized nature of the area where maintenance was required. To address concerns regarding storms, the FS, in Section 4.3, states that a higher factor of safety will be used, along with no movement criterion for the Permanent Cap. Additional discussion of the USACE reviews has been added to Section 2.5.3, and further discussion is provided as to how the Permanent Cap alternative (3N) addresses, and in some respects exceeds, USACE recommendations. |
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| 32 | (Section 3.3.1.5, p. 31) | The FS shall include "TPWD 2008" in the reference list. | Edit made to change this reference from TPWD 2008 to Riddell 2004. See Section 3.3.1.5. |
| 33 | (Section 4.1, p. 36) | The FS shall state the location of the following sample "The highest TEQDF concentration observed in subsurface soil is 303 ng/kg." | Added requested clarification and conforming statements for similar references in this section. The reference to this particular sample was deleted from the revised FS, and the discussion was modified to reflect other more relevant sample results. |
| 34 | (Section 4.2, p. 37) | This section states that deed restrictions will be placed south of 1-10 where the depth weighted average TEQ concentrations in the upper ten feet of subsurface soil exceed the soil preliminary remediation goal. The deed restrictions, in the form of restrictive covenant(s) if possible, shall be placed over the entire area of a given parcel of land within the Southern Impoundment area if any soil boring within that parcel has a depth weighted average TEQ within the upper five feet or within the upper ten feet of the subsurface soil that exceeds the preliminary remediation goal. To accomplish this, the FS shall evaluate the risk within the upper five feet as was done for the upper ten feet. | Additional text added to Section 3.1 to address this comment. |
| 35 | (Section 4.4, p. 40) | This section states that the raw material for solidification and stabilization could include fly ash or bottom ash. These ashes may contain elevated levels of metals. Also, 40 CFR § 423.12(b)(4) identified oil and grease as contaminants in the transport water associated with these wastes. The FS shall provide additional information demonstrating how the risks of introducing these contaminants into the river will be mitigated or minimized. | Retained Portland cement as an example reagent. Deleted reference to other reagents in the revised FS. |

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| 36 | (Section 5, p. 45) | The alternative evaluations in Section 5 shall have sub-headings for each of the CERCLA criteria, except state and community acceptance, which can only be addressed after a public comment period. | Change made as requested. |
| 37 | (Section 5.1.1, p. 47; and Section 5.2.1) | The section states that the no further remedial action alternative would be protective of human health and the environment. The TCRA cap is a temporary measure put in place until the final remedy can be selected. Also, cap design and/or construction issues have been identified by the USACE. The referenced statement shall be changed to relate that the no further action alternative is protective for the short term provided corrections identified by the USACE are completed. | Additional text has been added to address this comment directly in Section 5. Supplemental text has been provided in Section 4 to discuss the long-term protectiveness of caps. |
| 38 | (Section 5.1.2, p. 48) | The text states that 3 cap maintenance events are included for Alternative 1, but the cost table lists 6 cap maintenance events. The FS shall clarify the estimated number of cap maintenance events. | New text added as introduction to Appendix C, which includes clarification on this issue. The main FS text has been updated for consistency. |
| 39 | (Section 5.2.2, p. 50) | The second paragraph is confusing since it refers to Figure 2-3, but there are no sample IDs for SJB023 and SJB025 on the map. In addition, a 59.3 ng/kg location in the area south of I-10 could not be located on the figure. The text and/or figure shall be clarified. | The text referenced in the comment has been deleted from the revised FS. Note that the figure reference in the comment should have been to 2-5. |
| 40 | (Section 5.2.2, p. 51) | The text states that 3 cap maintenance events are included for Alternative 2, but the cost table lists 6 cap maintenance events. The FS shall clarify the estimated number of cap maintenance events. | New text added as introduction to Appendix C, which includes clarification on this issue. The main FS text has been updated for consistency. |
| 41 | (Section 5.3.1, p. 52) ***(Section 4.1.2, p . 37)*** | This section states that institutional controls would be used to establish limitations on dredging and anchoring. The FS shall clarify how the alternative will prevent damage associated with anchoring within the footprint of the permanent cap and how a dredging limitation will be imposed to insure that the upland sand separation area will not be disturbed. | Additional text has been added more thoroughly describing the proposed Institutional Controls that will address these issues. |

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| 42 | (Section 5.3.1, p. 52) ***(Section 4.3.2, p. 49)*** | The model predicts that additional sediment will be transported to this area, thus further inhibiting potential for contamination to reach receptors. However, there is the potential for the opposite effect if a large event actually erodes sediment. The monitored natural recovery plan shall include methods to determine if there has been erosion or deposition in the area. | Comment noted. Additional text has been added to the FS to acknowledge that the MNR plan would need to address the assessment of erosion and deposition, as requested. **But the changes do not indicate how monitoring would be conducted, as requested by EPA. EPA should provide to PRPs the overall scopes and responses required if erosion occurs (or other significant deviations from predictions are found, or threats to health or the environment discovered). Based upon this information, PRPs should develop an MNR plan for EPA's review.** |
| 43 | (Section 5.3.2, p. 54) | The FS Report shall provide a timeline for the ongoing monitoring mentioned in the last paragraph of this section. | Added text to describe Appendix C describing the timeline for monitoring, and acknowledging that this timeline is subject to USEPA review and approval. |
| 44 | (Section 5.4, p. 54) | As per Section 2.4.1 of the FS, salinity ranges in the River from 2 to 20 parts per thousand. The FS shall clarify what stabilizing agents will be considered for Alternative 4, and shall provide for the possible performance of a treatability study and include the costs. | Text added to give Portland cement as an example reagent and mention treatability testing. Comment noted on the river salinity. |
| 45a | (Section 5.4.2, p. 56) | This section includes several statements regarding the effectiveness of solidification/stabilization (S/S) treatments. For example, it "may reduce the potential mobility of soil/sediment exceeding PCLs using S/S treatment; however, those wastes are already adequately contained within the TCRA cap"; also, it "would provide marginal additional enhancement of the reliability of the containment"; and "the material that would be stabilized is already currently immobilized by the TCRA cap." The FS shall be revised to state that the S/S treatment will provide additional long term effectiveness compared to containment alone and will enhance the ability of the most highly contaminated material to withstand major flood events. | Text has been modified. New language indicates that S/S will enhance the strength of these sediments under the long-term effectiveness evaluation. |

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| 45b | (Section 5.4.2, p. 56) | The FS shall also note that, while a 100-year storm event is the usual design approach, it cannot be guaranteed that a storm event of even greater magnitude would never occur. | Additional text has been added in a new Section 4.1.3 that addresses this comment. While this comment is noted, larger storms are less problematic because the additional water depth reduces near bed velocity as described in the new text, which references the relevant evaluations conducted for the FS and documented in Appendix B. **Underlined text is disputed.**<br><br>**However, there is also a mis-direct in AQ's response. The issue is the force (or shear stress) of water acting on the bed and banks. Even simple hydraulics says that bottom (boundary average) shear stress (Tau) increases with increasing water depth (H) because Tau = Gamma H Sf, where Sf is the friction slope. Continuity says that flow (Q), velocity (V) and cross-section area (A), which equals width (B) times depth (H) are related: V = Q / A = Q / (B H). So velocity can only decrease when depth increases if both flow and width are constant. During a flood both flow and the flood channel area are changing.**<br><br>**Hydraulic geometry relationships indicate that velocity increases as flow increases: for example (see Julien and Wagardalam, 1995) V = 3.76 * (Q ^ 0.22) (Dsed ^ -0.05) (S ^ 0.39) if Q increases, there will be an increase in V.**<br><br>**The basic relationship (see Leopold, Wolman, and Miller, 1964) is V = k Q ^ m and m is an exponent greater than zero (m = 0.3 for the case shown in the book).**<br><br>**The NTSB report itself refutes the AQ response. Large floods cause a lot of erosion and can trigger channel realignment (e.g., meander loop cutoffs). The other problem is that the time and space scales of model development (e.g., mile-long reaches of river) are inconsistent with the scale of application for the FS (forces acting on a scale of 1-10 meters as needed to evaluate the effectiveness of a cap at a point).** |
| 45c | (Section 5.4.2, p. 56)<br>***(Section 4.2, p. 45)*** | Finally, the FS shall include a discussion about the preference for treatment, which will not be included in Alternatives 1, 2, or 3, but is a component of Alternative 4. | Additional text has been added to the long term effectiveness and reduction of TMV through treatment evaluations of revised FS. |

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| 46 | (Section 5.4.2, p. 57) ***(Section 4.3.3, p. 50)*** | The draft FS describes effectiveness issues related to use of sheetpiles. The FS shall be revised to recognize that a sheetpile can be designed and installed to make an effective barrier and over-come the issues listed in the Draft FS. For example, there would not be significant gaps in a properly designed and installed sheet pile barrier. In addition a sheet pile barrier could be installed outside the area of highly elevated contamination, which would reduce the potential for re-suspension of contaminated sediment during pile installation and removal. | The issues related to engineering controls described in the FS are well-documented in case studies. The discussion of these issues has been moved into a new section, and additional text has been added acknowledging that proper design and installation are critical for minimizing the potential issues that have been documented on other projects. However, sometimes "proper design" necessitates the use of features such as flow equalization ports to protect the barriers in flood situations, and these types of features can be an additional cause of releases. **Obviously, any feature of an alternative must be planned, designed and implemented with appropriate balance of risks and objectives. Each alternative is assumed to include those features needed for its effective function. If Respondents claim that an alternative is infeasible, they should be required to support that position with appropriate data and/or information.** |
| 47a | (Section 5.5.2, p. 60) | The draft FS states that the long-term effectiveness would be reduced by dredge residuals. The FS shall include a discussion that describes measures for addressing any dredge residuals, which may include additional dredging and/or placement of cover material over those areas. | Additional text has been added in a new Section 4 that describes removal-based alternative considerations, including dredging residuals and residuals management strategies included in the Draft Final Interim FS. |
| 47b | (Section 5.5.2, p. 60) | Further, the FS shall describe that this alternative will result in a substantial removal (about 25%) of the most highly contaminated material and result in a substantial improvement in long term effectiveness compared to alternatives I, 2, and 3, which do not remove any of the contaminated material and could result in a higher level release should unforeseen conditions result in a cap failure. | The modeling performed does not support a finding that the long-term effectiveness of this alternative is superior to Alternatives 1, 2, and 3. The text has been modified in this section acknowledging that this alternative removes a substantial quantity of higher concentration sediments from the Site. |
| 48 | (Section 5.5.2, p. 60) | The FS states that dredging may degrade the reliability of the existing containment due to scour; however, there is no explanation given. The FS shall describe why this could happen, and provide for proper design so that this will not be an issue. | Language has been modified to remove discussion regarding scour. |

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| 49 | (Section 5.5.2, p. 61) | The FS states that removal of the existing cap would increase the risk of a release of highly contaminated soil/sediment. The FS shall also include a discussion of the design approaches, control measures, etc. to minimize this issue, including but not limited to the use of operational controls (may include reduced dredge rates, reduced over-penetration, sequencing dredging etc.), and/or engineered controls including silt screens/curtains, sheet piles. coffer dams, inf1atable dams, etc. | Additional language has been added regarding measures that can be taken to mitigate release issues. The added text also includes discussion regarding documented effectiveness issues with these approaches. |
| 50 | (Section 6.1, p. 69) | The FS shall include a figure reference so the location of SJNE032 can be found. | Added reference to the revised FS. |
| 51 | (Section 6.7, p. 73) (Section 4.3.4 p. 54) | This section states that Alternatives 4, 5, and 6 provide no predicted benefit and significantly increase the risks from environmental impacts. However, stabilization or removal always provide better protection over the long term. The report shall acknowledge this. | Language has been modified to address this statement. |
| 52 | (Appendix A, Section 1.1, p. I, footnote) | The FS shall clarify whether the sensitivity analysis required by the US EPA in the letter dated September 12, 2012, is included as Section 2.2 in this document. This is not clear from the present slate of the text. | Text was added to clarify that the required sensitivity analysis were indeed performed and are described in Section 2.2. |
| 53 | (Appendix A, Section 2.1, p. I 0) | This section shall explain why the high flow event of 1994 was chosen over the other high f1ow events that occurred in the area. | Explanatory text was added as requested. |
| 54 | (Appendix A, Section 2.1, p. 12) | The last sentence before Section 2.2 states that the results from a 21-year sediment transport calibration simulation indicated that a net deposition will occur within the Site Perimeter on a "long- term basis". The FS shall define "long-term basis". Is this over that same 21-year period? If so, please state in the text. | Clarifying text was added as requested. |

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| 55 | (Appendix A, Figure 2-1) | There appears to be little change in water surface elevation at the lower boundary during large flood events. The FS shall clarify what this figure is indicating. In addition, the water surface elevation part of the figure shall show variations in water surface elevations for 2, 10, and 100 year events. | Clarifying text was added as requested. |

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| 56 | (Appendix A, Figure 3- 14) | In Figure 3-14, the chemical fate and transport model for the base case (pre-TCRA cap) conditions<br>shows water column concentrations of TCDD declining from approximately 0.06 pg/L at the upstream boundary below Lake Houston down to nearly 0.01 pg/L at river mile 5 upstream of the TCRA site, before rising to approximately 0.07 pg/L at the TCRA site, then rising further to approximately 0.2 pg/L at the lower boundary near the confluence with Buffalo Bayou. Neither these levels nor the pattern are supported by data collected by the TCEQ TMDL effort, even considering the model uncertainty bounds. The TCEQ TMDL data, measured between 2002 and 2012 using high-volume sampling for low detection levels, showed TCDD concentrations of no more than 0.1 pg/L upstream of the TCRA site, rising sharply to approximately I pg/L at the I-10 bridge near the TCRA (0.23 -2.16 pg/L .. average= 1.07 pg/L, n=6), then falling to an average 0.4 pg/L at the confluence with Buffalo Bayou. The FS shall discuss this difference and assess its impact on evaluating the remedial alternatives. | Anchor QEA disagrees with this comment. While we agree that the model-predicted spatial profile of pre-<br>TCRA water column concentrations shown on Figure 3-14 is somewhat different from that shown for the calibrated model and data shown on Figure 5-19 in Anchor QEA (2012), there are reasons for the apparent difference, including the following:<br><br>• Model results vary considerably over time and space. The results shown on Figure 3-14 represent an annual average of a laterally-averaged longitudinal profile for one example year of the simulation (Year 11). The annual average longitudinal profiles for all 21 years of the simulation (shown on Figures 1.1-1a through 1.1-1u in Attachment 1 to Appendix A), show considerable year to year variability in the model results. Much of that variability can be attributed to differences in flow, and particularly in the amount and frequency of days with zero freshwater inflow from Lake Houston Dam in a particular year.<br><br>• Figure 3-14 does not show the variability of daily model predictions over time (it only shows annual averages for the base case and upper/lower bound uncertainty simulations), nor does it show the spatial variability among the model grid cells included in the lateral averages. To better understand the range of TCDD concentrations predicted by the model within a given year, a new figure showing the longitudinal profile of model-predicted annual average concentrations (including the range of predictions associated with the base case simulation) in Year 11 was added to Appendix A (Figure 3-15). Near the TCRA Site, pre- TCRA TCDD concentrations range from 0.03 to 1 ng/L TCDD, which is generally consistent with water column data collected pre-TCRA in this area.<br><br>Clarifying text was added to Section 3.2.2.1 to explain these apparent differences, and to explain that the apparent differences do not affect the use of these simulations in the FS, because the primary purpose was to make relative comparisons between the various scenarios (i.e., between pre- and post-TCRA simulations in the case of Figure 3-14 and among remedial alternatives).<br><br>In addition, Anchor QEA is not aware of any 2012 water column data (as referenced in the comment); the statistics included in this comment match up well with water column data that were collected from 2002- 2005 (i.e., under pre-TCRA conditions). The model was demonstrated to calibrate well to water column data collected under pre-TCRA conditions. |

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| 57 | (Appendix A, Figures 3-15 and 3-16) | The FS shall explain why there is a dramatic change in flow variability from Lake Houston starting at year 7. | Explanatory text was added as requested. |
| 58a | (Appendix A, Table 4-2) | Table 4-2 includes TCDD and TCDF bed concentrations for the model for Alternative 6, the dredging alternative. The text states that the residuals layer concentration was set to the samples representative of the last dredge pass, or 3,956 ng/kg TCDD and 9,979 ng/kg TCDF. However, Alternative 6 is based on a full removal of materials exceeding the preliminary remediation goal of 220 ng/kg, so the samples representative of the last dredge pass would be 220 ng/kg and the corresponding residuals concentration would be 220 ng/kg. | Anchor QEA disagrees with this comment. Although Alternative 6 removes all sediment exceeding 220ng/kg TEQ, the concentration in the last dredge pass (used to define the residual layer concentration in the model) would not necessarily be 220 ng/kg. This is because the residual layer concentration was defined based on sampling data collected immediately above the 220 ng/kg TEQ depth horizon (which in many cases was considerably greater than 220 ng/kg TEQ), as discussed in the text. Additional text was added to Section 4.2.1.3 to further clarify this methodology.<br><br>To clarify one additional point, this comment also incorrectly compares a TEQ value (i.e., 220 ng/kg) with individual TCDD/TCDF concentration values. Because TCDD/TCDF are the chemicals simulated by the fate and transport model, and not TEQ, the applicable value would need to be expressed on the basis of those congeners. |
| 58b | (Appendix A, Table 4-2) | The assumed residual cover concentrations (in Table 4-2) of 198 ng/kg and 499 ng/kg for TCDD and TCDF, respectively, would result in a TEQ of 247.9 ng/kg, which is higher than the proposed preliminary remediation goal of 220 ng/kg and does not include the contribution from the other congeners. The FS shall clarify/revise the residuals layer concentration value used. | The methodology used to estimate the TCDD/TCDF concentration in the residual cover (i.e., 5 percent of the dredge residual concentration due to mixing when the cover is placed) is based on experience from other dredging projects and the assumed approach for managing dredge residuals with this alternative (i.e., 6" sand cover). The calculated concentration is based on the residual layer concentration estimated from the site data (see response to Comment #58a). To the extent that a particular residuals management approach would be used for a removal-based action, the approach would be assessed and refined during remedial design, and strategies developed to ensure the post-dredge concentration in the cover area achieves applicable RALs. The approach described in the FS made simplifying assumptions that are appropriate to allow for a comparative evaluation of alternatives. In the interest of retaining a simplified approach that allows "apples to apples" comparisons of removal-based alternatives, no changes have been made to the residuals cover evaluation in the Draft Final Interim FS. |

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| 59 | (Appendix B, Section 3.2, p. 6) | This section states that "the limited water depth prohibits large vessels from operating close to the cap." This is not true at the northwest corner closest to barge traffic associated with San Jacinto River Fleet operations. Storm events or human error may continue to pose a danger of barge contact with the cap. The FS shall include provisions for prevention of any damage as a result of large vessels operating close to the cap. | Additional text has been added under new section 4.1.3 to describe some potential measures that could be taken to prevent damage to the cap, with the presumption that the actual design of protective measures would be more fully assessed during remedial design. |
| 60 | (Appendix B, Figure 1 ) | This figure shall include the information source location and date range. | This information added and a revised figure has been provided. |
| 61a | (Table 4-1 and Appendix C) | The quantities in Table 4-1 and the cost estimate in Appendix C do not match and shall be corrected. Specific examples are listed below. For Alternative 4, Table 4-1 lists I ,400 linear feet of sheet pile, but the Appendix C cost table lists 800 linear feet. | Quantities have been updated in the Draft Final Interim FS to address this comment. |
| 61b | (Table 4-1 and Appendix C) | For Alternative 4, Table 4-I lists 3,400 cubic yards of armor rock and 6,900 cubic yards of TCRA armor rock replacement, but Appendix C cost table lists 6,100 tons of additional armor rock, replace 9,000 tons of armor rock A and replace 5,000 tons of armor rock C/D. | Quantities have been updated in the Draft Final Interim FS to address this comment. |
| 61c | (Table 4-1 and Appendix C) | The text in Section 4.4 states that the existing TCRA cap armor rock would be re-used if possible. This would also apply to Alternatives 4 and 5, but that is not stated in the text. Cost estimates in Appendix C for Alternatives 4 and 5 include costs of $682,000 for off-site disposal of TCRA riprap (i.e. armor rock) and $155,000 for washing riprap prior to disposal. The basis for these estimates shall be provided, as well as why reuse is discussed but disposal costs are included in the cost estimate. | It is true that this would apply to the other alternatives. However, beneficial use opportunities have not been identified and it has been our experience on other projects that there is not a ready market for this type of material, particularly when it is generated from a cleanup site. In light of these considerations, it has been assumed that the TCRA riprap would need to be disposed of at a construction debris landfill, after washing to remove any adhered fines. |
| 61d | (Table 4-1 and Appendix C) | The text in Section 4.5 and Table 4-1 states that Alternative 5 includes 53,300 cubic yards of dredging. The cost estimate in Appendix C lists 7,000 cubic yards of water based excavation/dredging and 46,300 cubic yards of land-based excavation, for a total of 53,300 cubic yards of removal. | Quantities have been updated in the Draft Final Interim FS to address this comment. |

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| 61e | (Table 4-1 and Appendix C) | The text in Section 4.6 and Table 4-1 says that Alternative 6 includes 208,000 cubic yards of dredging.<br>The cost estimate in Appendix C lists 208,300 cubic yards of water-based dredging and 46,300 cubic yards of land-based excavation. The FS shall provide consistent volumes. | Quantities have been updated in the Draft Final Interim FS to address this comment. |
| 62 | (Appendix C) | The cost estimates for Alternatives 5b, 6a, and 6b include $11.6 million, $10.3 million, and $63.7 million for mobilization/demobilization, respectively. The FS shall discuss the basis for these estimates. | Additional text has been prepared to introduce Appendix C, and costs have been updated for the Draft Final Interim FS to address this and other cost comments. |
| 63 | (Appendix C) | The cost estimate in Appendix C shows 421,500 tons for off-site disposal in Alternative 6. If the correct removal volume is 254,600 cubic yards (208,300 + 46,300), this is 1.65 tons per cubic yard. For Alternative 5, the weight is 74,600 tons for 53,300 cubic yards, or 1.4 tons per cubic yard. The conversion from volume to disposal weight is inconsistent and the FS shall either correct or clarify this difference. | Quantities have been updated in the Draft Final Interim FS to address this comment. |
| 64 | Multiple Areas | Please correct references to Section 2.6, which is not a section in the document | References corrected. These are actually section 2.5 references. |